Greetings and welcome to the ***DECEMBER 2016*** edition of the WDFW Climate News Digest, designed to provide highlights of climate change news, events and resources for WDFW staff. Feedback or suggestions for items to include in future editions are appreciated – *thanks* to those who have sent links and references and please keep them coming. Thanks for contributions this month from Wendy Connally, Teresa Scott, Bob Vadas and Jeff Marti (Ecology)

Other sources for news include: NPLCC Climate Science Digest, Climate.gov, NOAA Climate Newsletter, and "BioClimate", the newsletter of the USGS Climate Science Centers. Contact Lynn if you need information on subscribing directly to any of these.

WHAT'S HAPPENING IN OUR REGION?

Northwest Climate Magazine

An annual publication from the Northwest Climate Science Center, the Climate Impacts Research Consortium and the North Pacific Landscape Conservation Cooperative aimed at sharing stories about Northwest climate research. **Click Here to download the entire 2016 edition of NW Climate Magazine**

Or, find links to the individual stories below:

- Drought!**:** How the Northwest's recent drought provided a glimpse into our future and what's being done to plan for it
- Leave it to Beavers**:** How researchers from the Pacific Northwest and Great Basin are working with the toothy, hardworking beaver to restore river watersheds under threat from climate change
- Conservation Priorities in the Big Empty**:** An eco-regional approach to landscape conservation in the NW Great Basin
- Turning Conservation on its Head**:** Building a climate shield: Protecting our coldest streams to preserve biodiversity
- Science Without Borders**:** A look at how scientists with resource managers are hammering out useful tools and approaches to build habitat connectivity across political boundaries
- Lessons in the Ashes**:** How two geographers in Idaho are studying wildfire destruction in an effort to make our forests more resilient to climate change
- Can We Keep Salmon In The Nooksack?**:** The Nooksack Indian Tribe acts to understand a changing watershed

Snohomish Restoration Projects featured in the Resilient Lands and Waters Initiative *(from the National Fish Wildlife and Plants Climate Adaptation Strategy)*

NOAA is cultivating partnerships in Snohomish County to organize diverse agencies in their efforts to sustain water supply, restore fisheries, reduce flood risks, and support agricultural production. The crux of this approach involves designing floodplains that support multiple values, including support for rural economies and protection of tribal treaty rights, while anticipating the effects of climate change. Read about the project in the Resilient Lands & Waters Initiative Report and companion website .

RESOURCES

EPA Publishes its Latest Climate Indicators Report

In August, EPA launched the 4th edition of its climate change indicators report. The report, Climate Change Indicators in the United States, features **37** indicators and shows strong evidence of long-term changes to climate in the United States and around the world. The report includes **seven** new indicators: heat-related illnesses, West Nile virus, river flooding, coastal flooding, Antarctic sea ice, stream temperature, and marine species distribution. This edition also highlights climate change impacts on human health, with a focus on

people most at risk to climate-related stresses. You can request a print copy of the report at: climateindicators@epa.gov

Maryland Coastal Resiliency Assessment

With its extensive shoreline, Maryland's coasts experience flooding and erosion, caused by tides and storms and exacerbated by sea level rise. To support the DNR in their efforts to incorporate risk-reduction benefits into decision making, The Nature Conservancy (TNC) partnered with the Chesapeake and Coastal Services (CCS) to conduct a Statewide Coastal Resiliency Assessment. The results of this Assessment provide tools to target coastal adaptation efforts so that protecting or restoring natural habitats also provides the greatest risk reduction benefit to coastal residential communities.

Landscape Climate Dashboard

The Landscape Climate Dashboard allows users to explore future climate projections and soil site sensitivity for federally held protected lands across the California, Pacific Northwest, Great Basin and Great Northern Landscape Conservation Cooperative (LCC) boundaries. Try the tool!

Northwest Climate Hub Seedlot Selection Tool

The Seedlot Selection Tool (SST) is a GIS mapping program designed to help forest managers match seedlots with planting sites based on climatic information. The climates of the planting sites can be chosen to represent current climates, or future climates based on selected climate change scenarios.

Climate and health assessment kits now available from EPA

EPA has developed eight communication kits that summarize key points from *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment* for the different populations that are disproportionately affected by climate-change impacts. The agency is providing these materials for use and modification by anyone seeking to communicate the health impacts of climate change to a range of audiences. Access the kits.

Climate Change and Our Natural Resources: A Report from the Treaty Tribes in Western Washington

On November 15, 2016, the treaty tribes in western Washington released a comprehensive report on how climate change is hurting tribal treaty rights and natural resources. This report from the twenty member tribes of the Northwest Indian Fisheries Commission focuses on the impacts of climate change to our homelands, waters, and ways of life. We have a historical and contemporary relationship with the watersheds and ecosystems of the Pacific Ocean coast, the Strait of Juan de Fuca, Hood Canal, and Puget Sound. Virtually all of the resources and activities that our treaties protect—fishing, gathering, and hunting—are impacted by the effects of climate change. To download the report, visit: http://nwtreatytribes.org/climatechange/.

LEARNING OPPORTUNITIES

Lee Hotz: Inside an Antarctic Time Machine

In this TED talk, Wall Street Journal science columnist Lee Hotz describes the research of the Western Antarctic Ice Sheet Divide project, in which scientists examine ice core records of climate change in the past to help us understand climate change in the future.
Go To: http://ed.ted.com/lessons/lee-hotz-inside-an-antarctic-time-machine

The **National Adaptation Forum** is now accepting proposals for individual oral/poster presentations and Tools Cafe participation until December 16th. The National Adaptation Forum will be gathering in **Saint Paul, MN from May 9-11, 2017**.

CLIMATE SCIENCE NEWS

Study Points to Sharp Decline in Sub-Freezing Days *(from the NE Climate Science Center)*
A recent climate modeling study, supported by the Northeast CSC, projects a substantial decline in annual freezing days across North America. By mid-century, about 1 million square kilometers of North America (particularly in western areas) will no longer see sub-freezing winter temperatures, approximately 6 percent of the region that now experiences freezing weather. **Learn more >>**

Study shows North Cascades Glaciers shrinking rapidly *(from the Skagit Herald)*
An estimated 12.4 square miles of glacial ice has been lost in the Skagit watershed, home to the most glacial ice in the United States outside of Alaska, according to a recent study by staff from the North Cascades National Park Glacier Monitoring program.

More heat records expected *(from AP News and NOAA)*
If and when the nation warms another 4.5 degrees (2.5 degrees Celsius), expect there to be around 15 heat records for every cold one, a new study in the Proceedings of the National Academy of Sciences predicts. That warming can be as early as 50 years from now if greenhouse gas emissions continue at their recent pace or a century away if carbon pollution slows down.

Global average temperature *(from NOAA)*
NOAA recently reported that the 2016 year-to-date global temperature (January–October) was the highest for this period on record, at 1.75°F above the 20th century average of 57.4°F. With only two months left in the year, the globe remains on track to be one of the warmest years, if not the warmest, in the 122-year record.
Official confirmation of 2016's temperature status is expected in early 2017.

Sea ice extent *(from NASA)*
The extent of sea ice surrounding the Arctic and Antarctic regions are both at record lows for this time of year – marking the first time scientists have simultaneously tracked record low ice levels around each of the planet's poles. See the National Snow and Ice Data Center's real-time, interactive display of sea ice extent.

Office of the Washington State Climatologist – December Newsletter
The last OWSC newsletter edition of 2016 is now available on our website:
http://www.climate.washington.edu/newsletter/2016Dec.pdf
Fittingly, this month's special feature from Nick Bond is on trends in lowland snow around the state. Otherwise, the usual suspects are in there: November climate summary, Snowpack update, Precipitation and temperature outlook.

Is Arctic warming fueling severe winter weather in the mid-latitudes? *(from NOAA)*
James Overland, oceanographer at NOAA's Pacific Marine Environmental Lab, talks about his latest research on whether Arctic warming is fueling more severe winter weather in the mid-latitudes, the temperate zone of the Earth between the tropics and the Arctic, and the part of the United States where most Americans live.
Learn more »

SPECIES AND HABITATS

Climate change, hydrology and fish morphology *(from Climatic Change)*
In this recently published study, biologists used the relationship between genetic traits and specific species habitat to predict species ability to genetically adapt to future habitats under climate change. Specifically, the authors examined this method of evaluating climate change impact on biodiversity using the relationship between fish body shape and stream flow as a case study. The authors applied this phenotype-environment relationship (fish in high-flow habitats exhibit more streamlined body shapes than fish in low-flow habitats) to quantify changes in fish body shape under future streamflow conditions and to predict the ability of fish species to adapt to future conditions.

Evidence of birds adapting phenology to climate change (*from Global Change Biology)*
Molly McDermott and Lucas DeGroote from the Carnegie Museum of Natural History recently published a study examining climate-induced changes to the phenology of 21 species of passerine birds (perching birds) in Pennsylvania. The authors analyzed a 53 year-long record of reproductive timing and productivity of passerine birds from a single mist-netting station in western Pennsylvania and combined the data with long-term weather records. The findings indicate that many passerine birds are adapting to climate change. The authors concluded the study with an emphasis on the importance of long-term monitoring studies.

Huge Puffin Die-Off May Be Linked to Hotter Seas *(from National Geographic)*
Hundreds of birds are washing up dead in the Bering Sea, causing alarm among scientists. It may be linked to climate change.

Small Alpine Insects are Big Messengers of Climate Change *(from University of Kentucky)*
Two rare alpine insects — native to the northern Rocky Mountains and dependent on cold waters of glacier and snowmelt-fed alpine streams — are imperiled due to climate warming-induced glacier and snow loss according to a study by the U.S. Geological Survey (USGS) and its partners. The 20-year study provides the first comprehensive evaluation of the current status, distribution and habitat requirements for each species and was used to inform the status review for consideration of protection under the U.S. Endangered Species Act due to climate change-induced habitat loss. Researchers found the meltwater stonefly and western glacier stonefly have a narrow distribution and are restricted to short sections of cold, alpine streams often below glaciers predicted to disappear over the next two decades.

POLICY, MANAGEMENT, EDUCATION

Exploring Legal Adaptive Capacity and Federal Land Adaptation to Climate Change
A publication in the *University of Colorado Law Review* explores the concept of 'legal adaptive capacity' and how the extent of a regulatory agency's engagement in climate change adaptation is influenced by the flexibility of the goals under its authorizing legal framework. The authors compare the legal discretion of the BLM, FWS, NPS, and USFS.

A proposal for a National Wildlife Corridor System
Congressman Don Beyer has introduced a bill called the National Wildlife Corridors System that creates new tools for Federal agencies to create a system of corridors for wildlife connectivity.

New study: communities across U.S. pioneering innovative approaches to adapt to climate hazards *(from the Kresge Foundation)*

Communities across the nation are implementing innovative approaches to protect residents from the impacts of climate change, providing models and lessons that can be applied across the country. Climate Adaptation: The State of Practice in U.S. Communities is the first study to examine, in depth, actions that multiple municipalities are taking to address climate-change-fueled events like flooding, heat waves, wildfires, and intense storms.

USEFUL LINKS (*with thanks to the NPLCC for their help in compiling this list*)

Monthly Climate Newsletter for Washington State
Office of the Washington State Climatologist (OWSC)

National Integrated Drought Information System (NIDIS)
Pacific Northwest Drought Portal

Monthly U.S. and Global Climate Reports
National Centers for Environmental Information (NOAA), Climate Monitoring Division

University of Washington's Climate Impacts Group
The Climate Impacts Group (CIG) is an internationally recognized interdisciplinary research group studying the impacts of natural climate variability and global climate change ("global warming"). Visit their web page for access to research articles and other resource documents, including the State of Knowledge Report; Climate Change Impacts and Adaptation in Washington State: Technical Summaries for Decision Makers (2013), and State of Knowledge Report State of Knowledge: Climate Change in Puget Sound (2015)

Landscape Conservation Cooperatives
Landscape Conservation Cooperatives (LCCs) are a network of partnerships working in unison to ensure the sustainability of America's land, water, wildlife, and cultural resources. To learn more about the two LCCs in Washington, please visit North Pacific LCC and the Great Northern LCC. For even further information on LCCs please visit the LCC Network page.

Northwest Climate Science Center
The Northwest Climate Science Center provides climate science and decision support tools to address conservation and management issues in the Pacific Northwest Region. The NW CSC is part of a national network of Climate Science Centers (CSCs) providing actionable scientific information, tools, and techniques that land, water, wildlife, and cultural resource managers and other interested parties can apply to anticipate, monitor, and adapt to climate change impacts.

Climate.gov
NOAA Climate.gov is intended to be a source of timely and authoritative scientific data and information about climate. Our goals are to promote public understanding of climate science and climate-related events, to make our data products and services easy to access and use, to provide climate-related support to the private sector and the Nation's economy, and to serve people making climate-related decisions with tools and resources that help them answer specific questions

The Oregon Climate Change Research Institute (OCCRI), based at Oregon State University (OSU), is a network of over 150 researchers at OSU, the University of Oregon, Portland State University, Southern

Oregon University, and affiliated federal and state labs.

PNW Tribal Climate Change Network

The PNW Tribal Climate Change Network fosters communication between tribes, agencies, and other entities about climate change policies, programs, and research needs pertaining to tribes and climate change.

National Fish, Wildlife, and Plants Climate Adaptation Strategy

The National Fish, Wildlife, and Plants Climate Adaptation Strategy is aimed at providing a unified approach—reflecting shared principles and science-based practices—for reducing the negative impacts of climate change on fish, wildlife, plants, habitats and associated ecological processes across geographic scales.

Climate Change, Wildlife, and Wildlands Toolkit

The Climate Change, Wildlife and Wildlands Toolkit for Formal and Informal Educators is an updated and expanded version of the award-winning and very popular Climate Change, Wildlife and Wildlands Toolkit for Teachers and Interpreters, which was first published in 2001. The kit is designed for classroom teachers and informal educators in parks, refuges, forest lands, nature centers, zoos, aquariums, science centers, etc., and is aimed at the middle school grade level.

FWS Climate Change Information Toolkit

A key part of the Service's climate change strategy is to inform FWS staff about the impacts of accelerating climate change and to engage partners and others in seeking collaborative solutions. Through shared knowledge and communication, we can work together to reduce the impacts of climate change on fish, wildlife, plants and their habitats. Here are some **resources** that can help.